Multidimensional solitons in dispersive complex media: structure and stability. Applications

Vasily Yu. Belashov
Institute of Physics, Kazan Federal University, Kazan 420008, Russia

Abstract

This talk is devoted to a one of the most interesting and rapidly developing areas of modern nonlinear physics and mathematics – the analytical and advanced numerical study of the structure and stability of two- and three-dimensional solitons in dispersive complex media described by the generalized system which includes the Kadomtsev–Petviashvili and derivative nonlinear Schrodinger classes of equations and takes into account the generalizations relevant to various complex physical media, associated with the effects of high-order dispersion corrections, influence of dissipation and instabilities. This is consistent representation of the both early known and new original results obtained by author and also some generalizations in theory and numerical simulation of nonlinear waves and solitons in complex dispersive media. The analysis of stability of solutions is based on study of transformational properties of system Hamiltonian. The structure of possible multidimensional solutions is investigated using the methods of qualitative analysis of proper dynamical systems and analysis of solution asymptotics. Soliton interaction is studied numerically using specially developed numerical methods. Some applications in real physical media, such as soliton-like wave structures in plasma and fluids are discussed.